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Development and Validation of Agricultural Human-Wildlife Conflict Tolerance Scale for Farming Households

Arjun Prasad Verma[1], Bhanu Prakash Mishra[1], Dheeraj Mishra[1], Avanish Sharma[2], Rishabh Yadav[3]* and Divya Katiyar[4]

[1]Department of Agricultural Extension, College of Agriculture, [2]Department of Forest Biology and Tree Breeding, College of Forestry, [3]Young Professional, Department of Agricultural Extension, Banda University of Agriculture and Technology, Banda-210001, Uttar Pradesh, India
[4]Department of Extension Education, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India
*Corresponding author email id: rishabh123yadavcsa@gmail.com

HIGHLIGHTS

- A wildlife tolerance scale was developed and validated for buffer zone farmers consisting of 18 items, divided into 4 dimensions using EFA, explaining total variance of 67.41% and a Cronbach's α of 0.836.
- The majority (59.00%) of farmers residing in the buffer zones of Ranipur Tiger Reserve showed a medium level of tolerance.

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ABSTRACT

Agriculture–Human–Wildlife Conflict (AHWC) poses a significant threat to the livelihoods of agricultural households in buffer zones of protected areas across India. Measuring farmers' tolerance toward conflict is essential for designing effective conservation extension practices. The data was collected during March–April 2026 from 200 households residing in the buffer zone of Ranipur Tiger Reserve (RTR), Uttar Pradesh, to develop and validate the Wildlife Tolerance Scale for Buffer Zone Farmers. An initial pool of 50 items was generated and subjected to expert review by nine specialists using Content Validity Ratio (CVR). Items having CVR less than the threshold were removed, resulting in 43 items being tested on the final 200 households. After item-level reliability screening (corrected item–total correlation ≥0.30 and Cronbach's alpha >0.7), 18 items were retained for the main study. Retained items were analysed through Exploratory Factor Analysis (Direct Oblimin rotation). This resulted in four factors i.e. Adaptive Coexistence Behaviour, Coexistence Acceptance, Conservation-Oriented Tolerance, and Damage and Adaptation Tolerance. Final 18 items have a high internal consistency (α = .836) and explain a total variance of 67.41%. The WTS-BZF will provide extension workers and conservation practitioners with a validated instrument for assessing and enhancing wildlife tolerance among farming communities.

INTRODUCTION

Agriculture-Human–Wildlife Conflict (AHWC) is one of the most complex challenges in improving the agricultural livelihoods and biodiversity conservation in the buffer zones of protected areas. In India, the expansion of protected areas and recovery of megafauna populations under Project Tiger results in intense interactions between wildlife and farming communities living in buffer zones (Jhala et al., 2021). Households living in buffer zones routinely experience crop destruction, livestock predation and property damage by wild animals, resulting in significant economic losses and negative attitudes toward conservation efforts (Subedi et al., 2020). Ranipur Tiger Reserve (RTR), located in the

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Chitrakoot district of Uttar Pradesh, India, is a good example of such conflicts occurring in buffer-zone landscapes. Agricultural households in the buffer zones frequently encounter wildlife inhabiting in the RTR, making tolerance an important determinant for long-term coexistence. In this context, tolerance referred to the willingness of farming households to accept the presence of wildlife and bear associated costs without resorting to retaliatory or exclusionary actions (Slagle et al., 2013). Despite the various efforts and policies for conservation tolerance towards wildlife, it is inadequately measured in the context of South Asia. The majority of the tolerance measures were developed for Western or African contexts and do not capture the socio-ecological character of small and marginal farming communities in India (Kansky et al., 2016). Moreover, there is also a gap to measure tolerance towards AHWC among buffer-zone households in Indian reserve landscapes.

Agricultural extension contributes significantly to mediating human–wildlife coexistence by facilitating behavioural change, disseminating conflict-mitigation technologies, and building community capacity (Barua et al., 2013). Extension professionals also assess the baseline of tolerance level in rural households and monitor changes occurs due to the interventions introduced. For the above, they require a psychometrically robust, context-specific measurement tool. Though wildlife tolerance is recognised as an important determinant of successful human–wildlife coexistence, a standardised and contextually appropriate scale for assessing the tolerance level of households residing in the buffer zones of India is lacking. Therefore, the study tries to develop and validate the Wildlife Tolerance Scale for Buffer Zone Farmers (WTS-BZF). It is a measurement tool designed to assess the tolerance level of agricultural households residing in buffer zones toward wildlife in protected-areas. The instrument is expected to support the research, extension planning, and conservation initiatives aimed at fostering sustainable human–wildlife coexistence.

METHODOLOGY

The buffer area of the reserve forest is divided into seven ranges, namely Manikpur I, Manikpur II, Markundi I, and Markundi II, Karvi, Raipura and Bargarh. Four ranges were selected purposively on the basis of closest proximity to the RTR, followed by random village selection. Four villages were selected from each of Manikpur I and Markundi I, and six villages were selected from each of Manikpur II and Markundi II, yielding a total of 20 villages. The variation in village selection is due to differences in area where Manikpur I and Markundi I (2547.98 ha and 3291.34 ha) cover a small area compared to Manikpur II and Markundi II (6647.75 ha and 6331.65 ha). From each village, 10 households were randomly selected, resulting in a final sample of 200 households in the buffer zone. A cross-sectional household survey design was adopted, and data were collected through personal interview using the developed scale. The WTS-BZF was developed following a systematic multi-stage psychometric protocol.

Stage 1 Item Generation, an initial pool of 50 statements was collected through literature review, expert consultation and qualitative field observations (Maurya et al., 2024).

Stage II Content validation, the 50-item pool statements were submitted to a panel of 9 experts, including Subject matter specialists, extension scientists and Forest officers. Each expert rate each item as 'Essential', 'Useful but not essential', or 'Not necessary'. Content Validity Ratio (CVR) was computed for each item using Lawshe's (1975) formula:

$$CVR = (n_e - N/2) / (N/2)$$

For nine experts, the minimum acceptable CVR is 0.78 (Lawshe, 1975). Items with CVR < 0.56 were removed; items with CVR of 0.56 were revised and re-evaluated. This resulted in retention of 43 items.

Stage 3 Testing, the 43-items were used to collect survey data from 200 households living in the buffer-zone of RTR. Items were screened for corrected item–total correlation below 0.30, and improvement of Cronbach's alpha upon item deletion. Following this screening, 18 items were retained for the main study.

Stage 4 Main Study and Construct Validation, the data of the retained 18 scale items were used to check reliability using Cronbach's alpha. Construct validity was checked with Exploratory Factor Analysis (EFA) using Principal Axis Factoring (PAF) using Direct Oblimin rotation. A factorability confirmatory test was performed using Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. Factors were retained based on eigenvalue > 1, communalities ≥ 0.40, and pattern matrix loadings ≥ 0.50.

RESULTS

Content validity and item reduction

Expert panel reviewed the pool of 50 item and CVR values were used for systematic item reduction. Items TOL20, TOL29, TOL35–TOL37, TOL40 and TOL44 were removed as the CVR values were below the acceptable threshold of 0.56, or due to the overall consensus of the expert ratings that these items lacked sufficient discriminant content for the target population. Items with CVR of 0.56 (TOL10, TOL18, TOL28, TOL38, TOL41–TOL43, TOL46, TOL48) were revised for clarity before including in the final instrument. The CVR results for all 50 items are presented in Table 1. A total of 43 items were retained for final testing after content validation from the experts.

Testing and item screening

The 43-items retained after CVR screening were used for data collection from 200 households residing in the buffer-zone of RTR, Uttar Pradesh. Initially the reliability analysis was done using Cronbach's alpha of 0.688 with 43 items. Items were systematically screened using corrected item–total correlation (CITC) with the criterion that alpha should not improve substantially upon item deletion. Items with CITC < 0.30 were removed (TOL4-TOL12, TOL14-TOL34-TOL50), along with items where alpha-if-deleted exceeded the overall scale alpha. Following these criteria for screening, 18 items were retained. Re-analysis of the retained 18-items result in a substantially improved Cronbach's alpha of 0.836, confirming an adequate internal consistency of the scale. The pilot reliability statistics are presented in Table 2.

Factor extraction

Before analysing EFA, the correlation matrix was assessed (Table 3) to determine the factorability of the 18 items. The Kaiser–

Table 1. Content Validity Ratio (CVR) and testing reliability

Item	Content Validity Ratio (CVR) results for initial 50 items (Expert panel, N = 9)					Testing reliability statistics of before and after item screening (n=200)				
	Essential (ne)	Useful	Not Necessary	CVR	Decision	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's α if Item Deleted	Decision
						Before item screening: α = .688, 43 items				
TOL1	9	0	0	1.00	Keep	97.99	92.41	0.345	0.674	Retained
TOL2	8	1	0	0.78	Keep	97.97	93.19	0.304	0.676	Retained
TOL3	9	0	0	1.00	Keep	97.99	93.23	0.310	0.676	Retained
TOL4	9	0	0	1.00	Keep	98.92	95.11	0.272	0.689	Removed
TOL5	8	1	0	0.78	Keep	98.04	98.40	-0.024	0.695	Removed
TOL6	9	0	0	1.00	Keep	98.82	95.64	0.214	0.69	Removed
TOL7	9	0	0	1.00	Keep	98.91	95.18	0.182	0.692	Removed
TOL8	8	1	0	0.78	Keep	98.75	96.03	0.097	0.695	Removed
TOL9	9	0	0	1.00	Keep	98.68	96.74	0.045	0.698	Removed
TOL10	7	2	0	0.56	Revise	98.59	97.15	-0.018	0.702	Removed
TOL11	8	1	0	0.78	Keep	97.40	97.88	-0.020	0.699	Removed
TOL12	9	0	0	1.00	Keep	98.48	96.96	0.019	0.696	Removed
TOL13	8	1	0	0.78	Keep	97.91	93.80	0.342	0.679	Retained
TOL14	9	0	0	1.00	Keep	98.97	94.92	0.258	0.689	Removed
TOL15	8	1	0	0.78	Keep	98.94	95.27	0.241	0.691	Removed
TOL16	9	0	0	1.00	Keep	99.02	98.13	0.245	0.692	Removed
TOL17	9	0	0	1.00	Keep	98.88	95.88	0.126	0.694	Removed
TOL18	7	2	0	0.56	Revise	98.79	96.26	0.081	0.696	Removed
TOL19	9	0	0	1.00	Keep	98.92	91.13	0.435	0.669	Retained
TOL20	6	2	1	0.33	Remove	-	-	-	-	-
TOL21	9	0	0	1.00	Keep	99.15	93.39	0.340	0.676	Retained
TOL22	9	0	0	1.00	Keep	99.07	93.41	0.346	0.675	Retained
TOL23	8	1	0	0.78	Keep	99.30	93.56	0.350	0.676	Retained
TOL24	9	0	0	1.00	Keep	99.29	93.33	0.373	0.675	Retained
TOL25	9	0	0	1.00	Keep	99.24	92.46	0.429	0.672	Retained
TOL26	8	1	0	0.78	Keep	99.19	92.16	0.464	0.670	Retained
TOL27	9	0	0	1.00	Keep	99.29	92.46	0.432	0.672	Retained
TOL28	7	2	0	0.56	Revise	99.28	93.70	0.360	0.676	Retained
TOL29	6	2	1	0.33	Remove	99.21	93.61	0.302	0.676	Retained
TOL30	8	1	0	0.78	Keep	99.00	93.56	0.330	0.676	Retained
TOL31	9	0	0	1.00	Keep	98.99	93.68	0.324	0.677	Retained
TOL32	9	0	0	1.00	Keep	99.06	93.56	0.328	0.676	Retained
TOL33	9	0	0	1.00	Keep	99.03	94.42	0.312	0.680	Retained
TOL34	8	1	0	0.78	Keep	98.71	96.42	0.143	0.694	Removed
TOL35	6	2	1	0.33	Remove	-	-	-	-	-
TOL36	6	2	1	0.33	Remove	-	-	-	-	-
TOL37	6	2	1	0.33	Remove	-	-	-	-	-
TOL38	7	2	0	0.56	Revise	98	96.88	-0.010	0.704	Removed
TOL39	8	1	0	0.78	Keep	98.31	98.34	-0.061	0.707	Removed
TOL40	6	2	1	0.33	Remove	-	-	-	-	-
TOL41	7	2	0	0.56	Revise	98.27	98.61	-0.073	0.708	Removed
TOL42	7	2	0	0.56	Revise	97.88	98.34	-0.062	0.710	Removed
TOL43	7	2	0	0.56	Revise	98.57	97.03	0.041	0.698	Removed
TOL44	6	2	1	0.33	Remove	-	-	-	-	-
TOL45	8	1	0	0.78	Keep	98.49	97.28	0.018	0.700	Removed
TOL46	7	2	0	0.56	Revise	98.42	97.63	-0.006	0.702	Removed
TOL47	8	1	0	0.78	Keep	98.35	98.05	-0.052	0.706	Removed
TOL48	7	2	0	0.56	Revise	98.51	97.19	0.022	0.700	Removed
TOL49	8	1	0	0.78	Keep	98.44	97.46	0.009	0.701	Removed
TOL50	9	0	0	1.00	Keep	98.29	98.27	-0.058	0.706	Removed

Table 2. Testing reliability statistics after item screening

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item–Total Correlation	Cronbach's α if Item Deleted
After item screening: α = .836, 18 items retained				
TOL1	34.04	42.31	0.411	0.829
TOL2	34.02	42.85	0.371	0.831
TOL3	34.04	42.98	0.368	0.831
TOL13	33.96	42.41	0.402	0.830
TOL19	34.97	41.37	0.512	0.823
TOL21	35.2	42.71	0.45	0.827
TOL22	35.12	43.57	0.365	0.831
TOL23	35.35	43.28	0.415	0.829
TOL24	35.34	42.71	0.489	0.825
TOL25	35.29	42.19	0.536	0.823
TOL26	35.24	42.59	0.501	0.825
TOL27	35.34	42.54	0.497	0.825
TOL28	35.33	42.54	0.532	0.824
TOL29	35.01	43.51	0.302	0.835
TOL30	35.05	43.25	0.395	0.830
TOL31	35.04	42.7	0.422	0.828
TOL32	35.11	42.89	0.431	0.828
TOL33	35.08	43.22	0.384	0.830

Table 3. KMO and Bartlett's test of sphericity for the final 18 items (n = 200)

Test	Value
Kaiser–Meyer–Olkin value	0.837
Bartlett's Test of Sphericity — Approx. χ^2	1790.848
df	153
Significance (p)	<0.001

Meyer–Olkin (KMO) was assessed to measure the sampling adequacy (0.837), and was above the recommendation of 0.7, It indicates that inter-item correlation patterns were suitable for factor analysis. Additionally, Bartlett's test was also significant (χ^2 = 1790.848, df = 153, p < .001), it shows that correlation matrix was not just an identity matrix and a common variance is present.

Direct Oblimin rotation was used in Principal Axis Factoring which extracted four factors having eigen values more than 1.0 and explaining a total variance of 67.41%. Factor 1 (eigenvalue = 5.044, 28.02% variance), Factor 2 (eigen value = 3.098, 17.21%), Factor 3 (eigenvalue = 2.730, 15.17%), and Factor 4 (eigen value = 1.262, 7.01%). All communalities exceeded 0.30, and all pattern matrix loadings were more than the 0.50 threshold.

Factor structure and scale interpretation

The rotated pattern matrix revealed a clean four-factor structure with no problematic cross-loadings. The factor inter-correlation matrix indicates a moderate correlation between factors (ranging from 0.10 to 0.52), supporting the use of oblique rotation and confirming that the factors were conceptually distinct and share a common latent construct of wildlife tolerance. Factor 1 representing Adaptive Coexistence Behaviour (6 items: TOL23, TOL27, TOL24, TOL28, TOL25, TOL26), captures respondents' willingness to adopt preventive farming practices and participate in community-level conflict-mitigation efforts. Higher scorers indicate proactive behavioural orientations toward reducing HWC through adaptation rather than exclusion of wildlife. Factor 2 represents Coexistence Acceptance (4 items: TOL1, TOL3, TOL2, TOL13), which reflect fundamental acceptance of wildlife presence and coexistence near agricultural landscapes. Items loaded strongly on this factor,

Table 4. Rotated factor pattern matrix (Principal Axis Factoring, Direct Oblimin rotation; n = 200)

Item	F1 Adaptive Coexistence	F2 Coexistence Acceptance	F3 Conservation Tolerance	F4 Damage & Adaptation Tolerance*	Communality
TOL23	0.917				0.668
TOL27	0.684				0.576
TOL24	0.653				0.508
TOL28	0.637				0.508
TOL25	0.558				0.539
TOL26	0.545				0.572
TOL1		0.884			0.794
TOL3		0.842			0.704
TOL2		0.840			0.701
TOL13		0.792			0.640
TOL29			0.966		0.887
TOL31			0.711		0.523
TOL32			0.664		0.472
TOL30			0.656		0.455
TOL33			0.643		0.427
TOL19				–.750	0.642
TOL21				–.585	0.429
TOL22				–.512	0.416
Eigenvalue	5.044	3.098	2.730	1.262	
% Variance	28.02	17.21	15.17	7.01	
Cumulative %	28.02	45.23	60.40	67.41	

Note: Loadings <0.50 suppressed. (R) = items reverse-scored for Factor 4. Extraction: Principal Axis Factoring; Rotation: Direct Oblimin. Overall α =0.836.

suggesting a stable attitudinal core around –human-wildlife cohabitation. Factor 3 represents Conservation-Oriented Tolerance (5 items: TOL29, TOL31, TOL32, TOL30, TOL33), it shows farmers' broader conservation values, support for continued wildlife conservation despite inconvenience, importance of environmental balance, and responsibility toward future generations. Factor 4 represents Damage and Adaptation Tolerance (3 items: TOL19, TOL21, TOL22), items on this factor originally loaded negatively in the pattern matrix, indicating that scores were inversely related to the general tolerance direction. Following standard psychometric practice, these items were reverse-scored. After reversal, high scores on Factor 4 indicate willingness to accept wildlife-related losses as manageable and readiness to modify farming systems in response to conflict. This factor represents tolerance at the interface of material cost-acceptance and behavioural flexibility. The rotated factor matrix (pattern matrix) is presented in Table 4.

Final selected statements were represented in the table 5 and it is used in the final survey of 200 households residing in the buffer zone of four range in RTR, Uttar Pradesh. Statements were categorised in to different factors according to the results of EFA along with their Cronbach alpha value of each factor.

Tolerance level of households in RTR buffer zones

Normalised scores of the tolerance scores were categorised into three categories, i.e., low tolerance, medium tolerance, and high tolerance level. Tolerance of different households in different ranges was presented in Table 6. Households in the Manikpur I range have the lowest tolerance, as the majority (Low: 42.50%; Medium: 55.00%) of households have a low to medium level of tolerance towards wildlife. Whereas Markundi II has a medium to high level of tolerance (Medium: 61.67%, High: 28.33%). Overall, households residing in the Buffer zones of RTR, Uttar Pradesh, have a low (23.00%) to medium level (59.00%) of tolerance.

Table 6. Tolerance level of households in RTR buffer zones

Range	Low Tolerance (%)	Medium Tolerance (%)	Highly Tolerance (%)
Manikpur I	42.50	55.00	2.50
Manikpur II	23.33	56.67	20.00
Markundi I	22.50	62.50	15.00
Markundi II	10.0	61.67	28.33
Overall	23.00	59.00	18.00

DISCUSSION

The nine experts reviewed the50 items and were analysed using Content Validity Ratio (CVR), resulting in the retention of 43 items, and 7 items were removed due to consistently low expert agreement. The majority of the removed items were affective and ask about the feelings that were removed and can also be observed in other scale construction methodologies (Kansky et al., 2016; Prabex et al. 2025). Items that received consensus or agreement of the experts (CVR = 1.00) were majorly behavioural and experiential acceptance of wildlife presence, participation in mitigation, and coexistence values, suggesting that agricultural wildlife tolerance in buffer-zone contexts is anchored to practical experience rather than emotional disposition. These findings are consistent with the previous researches related to conservation social science, concluding that direct experience with wildlife majorly shapes tolerance than abstract value orientations (Yeshey et al., 2024; Velamuri et al. 2024; Kademani et al., 2025).

The initial Cronbach's alpha of 0.688 with 43 items indicated marginal reliability, which improved substantially to 0.836 following

Table 5. Final Wildlife Tolerance Scale for Buffer Zone Farmers (WTS-BZF): items, factors, and scoring

Item Code	Statement
Factor 1: Adaptive Coexistence Behaviour (6 items, α = 0.82)	
TOL23	I would use preventive measures before resorting to wildlife removal
TOL27	I am willing to participate in community efforts to reduce human–wildlife conflict
TOL24	I prefer coexistence measures rather than removing wildlife from the area
TOL28	I would support village-level wildlife mitigation programs
TOL25	I am willing to spend time protecting crops through non-lethal methods
TOL26	I support solutions that reduce conflict without harming wildlife
Factor 2: Coexistence Acceptance (4 items, α = 0.88)	
TOL1	I accept the presence of wildlife near my village
TOL3	People and livestock should coexist with wildlife in my community
TOL2	I believe humans and wildlife should be able to live side by side
TOL13	I can tolerate occasional agricultural losses caused by wildlife
Factor 3: Conservation-Oriented Tolerance (5 items, α = 0.83)	
TOL29	I would cooperate with local conservation initiatives
TOL31	Wildlife conservation should continue even if some inconvenience is experienced
TOL32	Protecting wildlife is important for maintaining environmental balance
TOL30	Wildlife conflict should be addressed through adaptation rather than elimination
TOL33	Future generations should benefit from maintaining wildlife populations
Factor 4: Damage and Adaptation Tolerance (3 items, α = 0.79)	
TOL19	Wildlife-related losses should be managed rather than eliminated
TOL21	I am willing to make adjustments to my farming practices to accommodate wildlife
TOL22	I am willing to change agricultural practices to reduce wildlife conflict

systematic removal of items with near-zero or negative corrected item–total correlations (CITC). The final 18-item pool exhibited CITC values ranging from 0.302 to 0.536, with no individual item deletion improving the overall alpha, confirming that each retained item contributed unique and coherent variance to the composite tolerance construct. An alpha of 0.836 meets the threshold of 0.80 considered acceptable for social science instruments (Kalkbrenner, 2021; Jahangiry et al., 2025). The iterative item-screening approach used here mirrors the procedures reported by Patra et al. (2026) in their development of a farmer adaptation scale in eastern India, where progressive item removal raised alpha from .65 to .82 across a comparable item pool.

The KMO value of .837 and a significant Bartlett's test ($p < .001$) confirmed strong factorability, and Principal Axis Factoring extracted a theoretically coherent four-factor solution explaining 67.41% of total variance. Factor 1 (Adaptive Coexistence Behaviour; 28.02% variance) emerged as the dominant component, with the highest-loading item being willingness to use preventive measures before resorting to wildlife removal (TOL23 = .917). The primacy of this behavioural orientation factor aligns with the Theory of Planned Behaviour (Islam and Mehidi, 2024), which identifies behavioural intention as the proximal determinant of action — making this dimension the most extension-amenable, as intentions are modifiable through skill-building and community demonstration programmes. Factor 2 (Coexistence Acceptance) reflected fundamental attitudinal acceptance of human–wildlife cohabitation, and the loading of the loss-acceptance item (TOL13 = 0.792) on this factor rather than on the damage-specific Factor 4 — suggests that occasional loss-tolerance is embedded in broader coexistence worldviews in this landscape rather than being experienced as a discrete economic decision (Denryter and Heeren, 2021). Factor 3 (Conservation-Oriented Tolerance) captured biospheric value orientations, with the dominant loading of the cooperation item (TOL29 = 0.966) indicating that conservation efficacy beliefs are a distinct and independent dimension of tolerance (Hobson et al., 2024). Factor 4 (Damage and Adaptation Tolerance) presented negative loadings in the raw pattern matrix, consistent with findings by Kortetmaki et al. (2025) and Sasikumar et al. (2026) who noted that cost-bearing items are frequently interpreted as signalling unfair burden in rural conflict contexts. Reverse-scoring resolved this artefact, yielding a conceptually meaningful dimension representing farmers' capacity to frame losses as manageable and to accept farming-system adaptation.

Application of the WTS-BZF to the full sample revealed a predominantly low-to-medium tolerance distribution (23.00% low; 59.00% medium; 18.00% high), consistent with previous HWC research from South Asian tiger reserve landscapes documenting pervasive negative attitudes among smallholder farming communities (Agnihotri et al., 2021; Warrier, 2019). Range-level variation was notable: Manikpur I recorded the highest proportion of low-tolerance households (42.50%), which may reflect its smaller spatial area and correspondingly higher habitat-edge density and conflict frequency, as greater proximity to wildlife habitats has been linked to suppressed tolerance through negative reinforcement (Harris et al. 2023; Iqbal et al., 2021). In contrast, Markundi II showed the lowest low-tolerance proportion (10.00%) and the highest medium-to-high tolerance, potentially attributable to greater physical buffering from the reserve core. The majority of households across all ranges are in the medium-tolerance level which identifies a priority target segment for agricultural extension and individuals in intermediate attitudinal zones are consistently found to be most responsive to information-based and community-norm interventions (Junca et al., 2023; Meena et al., 2022). The scale's ability to detect meaningful sub-range variation in tolerance further confirms its discriminant validity and suitability as a diagnostic tool for range-specific extension planning within tiger reserve governance structures.

CONCLUSION

The Wildlife Tolerance Scale for Buffer Zone Farmers (WTS-BZF) is a psychometrically validated scale, consisting of18 items, and responses can be collected on a 5-point Likert instrument for measuring agricultural human–wildlife conflict tolerance among buffer-zone households. Developed through rigorous content validation (CVR with nine experts), systematic pilot-phase item screening (Cronbach's $\alpha = 0.836$ post-refinement), and Exploratory Factor Analysis on 200 households of Ranipur Tiger Reserve, Uttar Pradesh. The scale yields four interpretable and internally consistent dimensions namely Adaptive Coexistence Behaviour, Coexistence Acceptance, Conservation-Oriented Tolerance, and Damage and Adaptation Tolerance. Together, these dimensions explain 67.41% of total variance in wildlife tolerance. The WTS-BZF addresses a significant methodological gap in South Asian human–wildlife conflict research and provides extension workers, conservation planners, and programme evaluators with a ready-to-use, context-validated tool for assessing tolerance baselines, monitoring intervention outcomes, and designing community-level coexistence programmes in tiger reserve buffer zones across India.

DECLARATIONS

Ethics statement: The study was conducted in accordance with ethical research standards. Participation was voluntary, and informed consent was obtained from all respondents. The confidentiality and anonymity of participants were strictly maintained throughout the research process.

Competing interests: The authors declare that there are no conflicts of interest regarding the publication of this paper.

Data availability statement: Data is available upon request from the first author as well as co-authors.

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